Using ASCII-Stored Files

The ASCII waveform storage feature allows waveforms to be stored to a mass-memory device in any of three ASCII formats: Spreadsheet, Mathcad and MATLAB. Each format is tailored for a commonly used analysis package. The user-interface changes supporting ASCII waveform storage are found in the STORE menu (*see Chapter 13*).

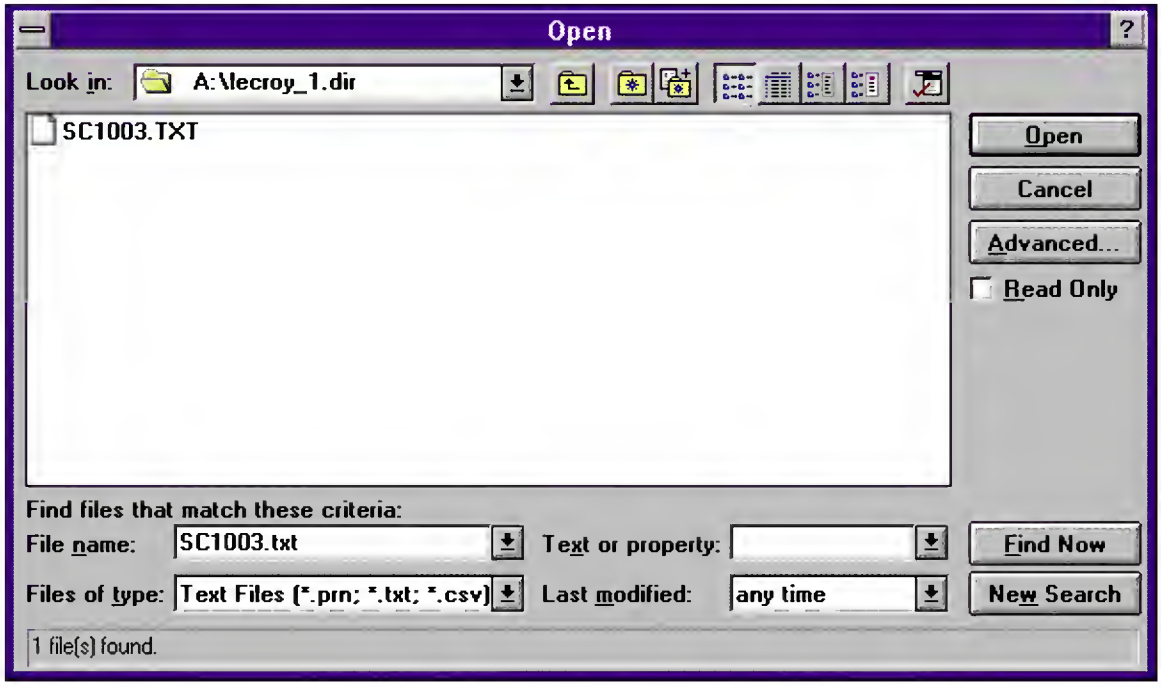
The table below summarizes the three formats' basic layout. Examples of the use of each format are given on the following pages.

Format	Header *Format includes some form of header before the data*	Time Values *Format stores time values with each amplitude value*	Amplitude Values *Format stores amplitude values*	Sequence Times *Header contains sequence time information for each sequence segment*	Multi-Segment *Format concatenates multiple segments of a sequence waveform*	Dual Array *Format allows dual-array data (i.e. Extrema, or complex FFT) to be stored*
Spreadsheet	Yes	Yes	Yes	Yes	Yes	Yes
Mathcad	Yes	Yes	Yes	Yes	Yes	Yes
MATLAB	No	No	Yes	No	Yes	No

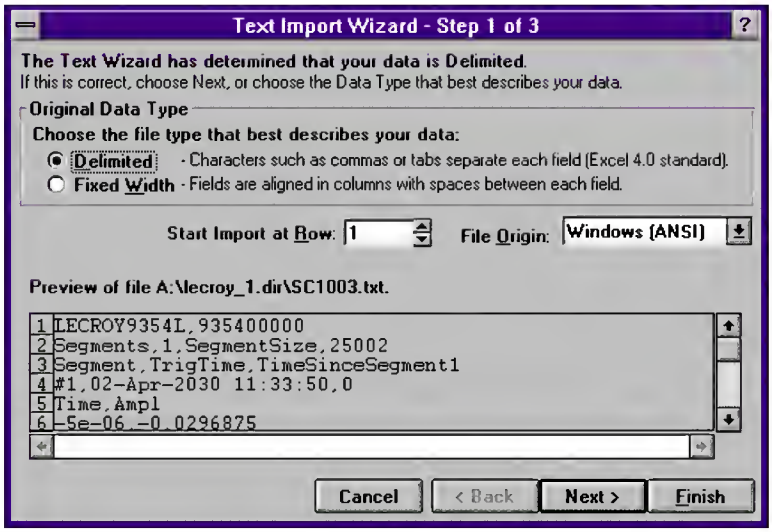
***Note:** Once stored in ASCII, waveforms cannot be recalled into the DSO.*

Using the Spreadsheet Format with Excel

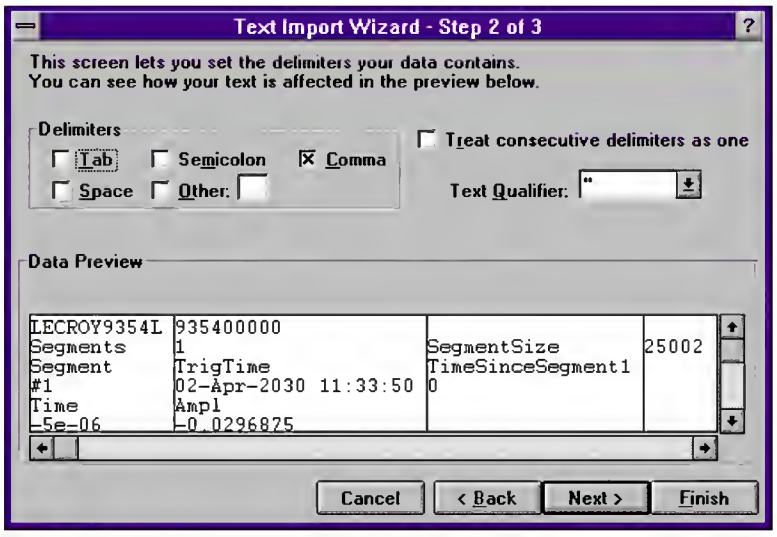
This example was created using Microsoft Excel, Version 7.0 for Windows. A waveform stored in Spreadsheet format may be read into Microsoft Excel using the File -> Open dialog as follows:



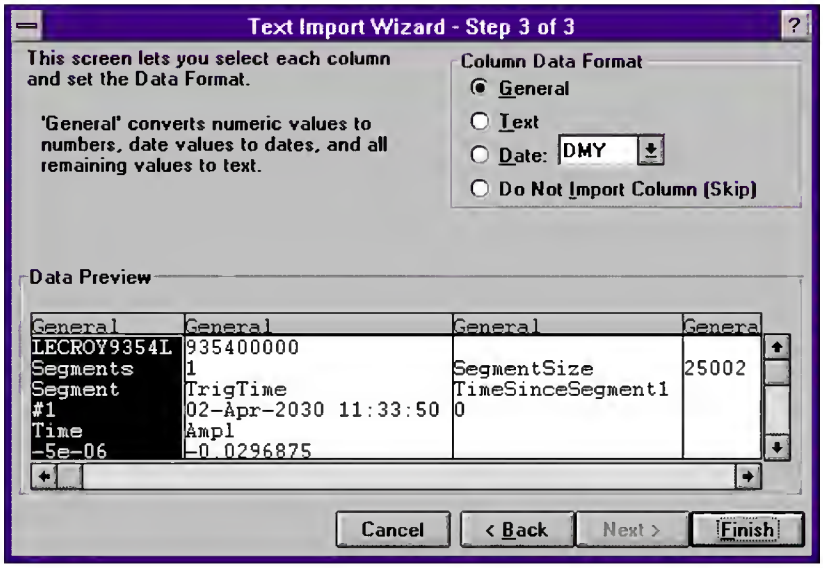
Excel will now ask for more information about the file type. Ensure that the 'Delimited' option is selected in the first step of the Wizard.



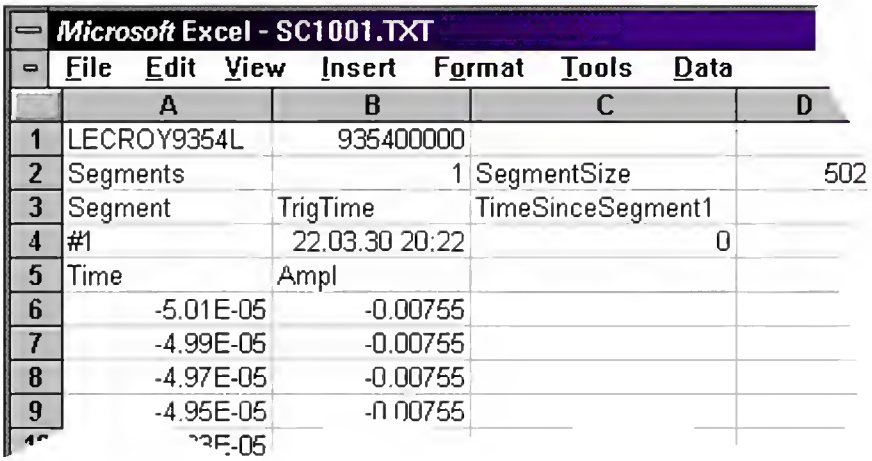
The next step allows the specific delimiter to be specified. The Spreadsheet format generated by the scope uses a comma (,) to delimit columns. Ensure that this is selected.



The third and final step allows the format of the columns to be specified. The 'general' format for each column should be used (this is the default).



After clicking the Finish button, a display similar to that following should be displayed.



Microsoft Excel - SC1001.TXT

File Edit View Insert Format Tools Data

	A	B	C	D
1	LECROY9354L	935400000		
2	Segments	1	SegmentSize	502
3	Segment	TrigTime	TimeSinceSegment1	
4	#1	22.03.30 20:22	0	
5	Time	Ampl		
6	-5.01E-05	-0.00755		
7	-4.99E-05	-0.00755		
8	-4.97E-05	-0.00755		
9	-4.95E-05	-0.00755		

Plotting a Single-Segment Waveform

Plotting the data from a single-segment waveform requires the use of a scatter plot based on the data in the first two columns with the first column used as the X values.

Extracting Segments from Sequence Waveforms

The header created for the Spreadsheet format contains all the information required to extract various elements of a sequence waveform. The following Formulae may be used to extract information such as the start and end row of the data for a given segment, or the trigger time of a given segment.

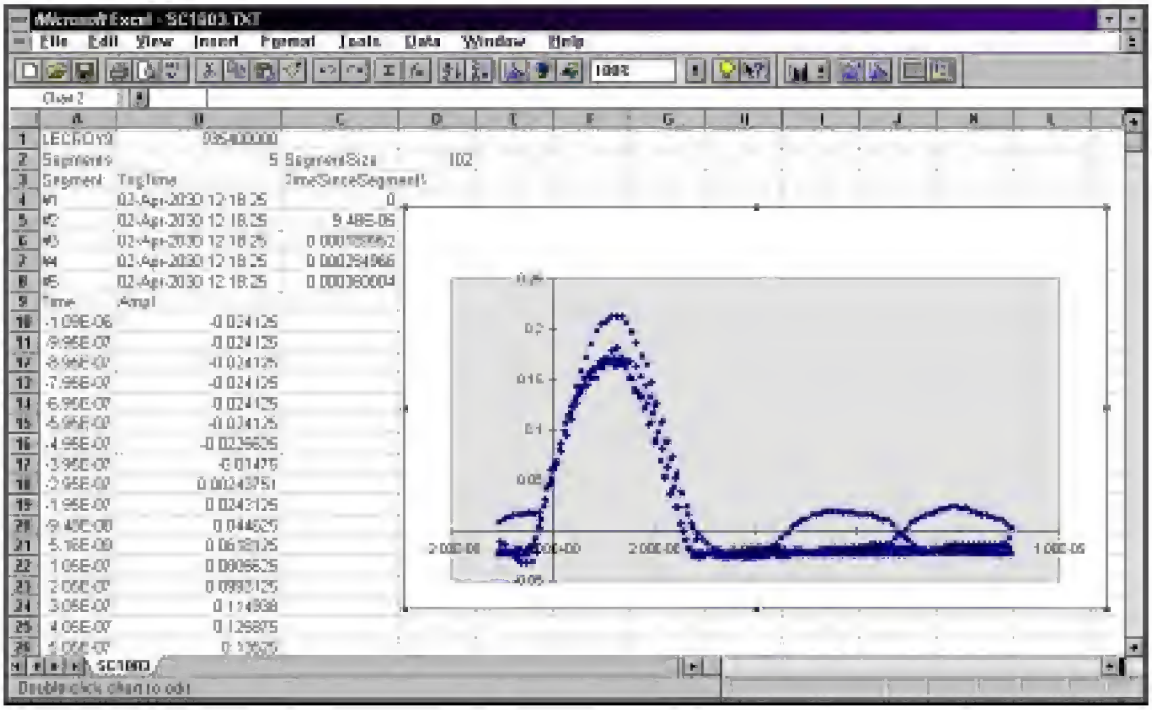
SegmentStartRow := (*DesiredSegment* * D2) + B2 + 5

SegmentEndRow := *SegmentStartRow* + D2 -1

TrigTime= INDIRECT(ADDRESS(*DesiredSegment* +3;2;4))

TimeSinceFirstTrig= INDIRECT(ADDRESS(*DesiredSegment* +3;3;4))

Plotting the data from all segments using a scatter plot will result in all segments overlaid (similar to the scope's display of sequence traces in persistence mode).


Microsoft Excel - SC1803.TXT
File Edit View Insert Format Tools Data Window Help
LECROY3
Segments
SegmentSize
Segment
TrgTime
TimeSinceSegment1
Time
Ampl
SC1803

Using Mathcad

These examples were created using MathSoft's Mathcad for Windows. On this and the next page, the procedure for reading and graphing a file for a single segment is shown, using Mathcad Versions 3.1 and 7, respectively. The example on page E–9 is for multiple segments.

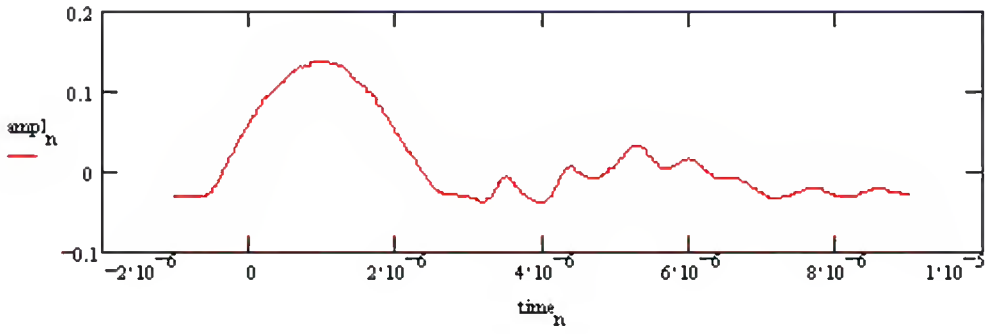
Single-Segment, Version 3.1 This single-segment example illustrates the use of Mathcad Version 3.1:

$a := READPRN(sc1004)$ Read data from file sc1004.prn into matrix 'a'

$n := 2.. \left(1 + a_{0,1}\right)$ Create ramp over all rows containing data

$time := a^{\langle 0 \rangle}$ Extract time vector

$ampl := a^{\langle 1 \rangle}$ Extract amplitude vector



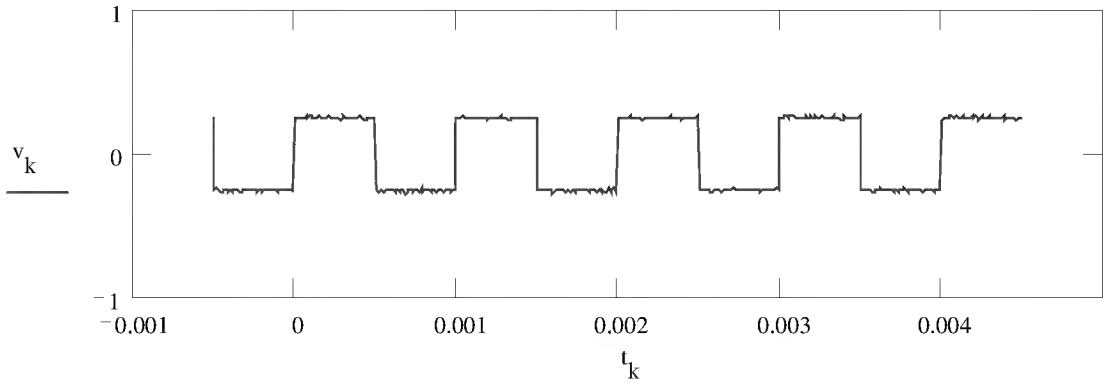
Single-Segment, Version 7 This single-segment example is valid for more recent versions of Mathcad:

$A := \mathrm{READPRN}(\mathrm{file})$

$K := \mathrm{last}\left(A^{\langle 0 \rangle}\right)$

$A := \mathrm{submatrix}(A, 2, K, 0, 1)$

$t := A^{\langle 0 \rangle} \qquad v := A^{\langle 1 \rangle} \qquad K := \mathrm{last}(t) \qquad k := 0..K-1$



Multi-Segment Example

The following Mathcadexample demonstrates how to extract data from a given segment. The data used for this example consisted of two segments of three samples each, allowing the entire imported matrix to be shown.

Read data from file

$a := READPRN(sc1000)$

$$a = \begin{bmatrix} 2 & 3 \\ 1 & 0 \\ 2 & 999 \\ 1 & 1 \\ 1.1 & 2 \\ 1.2 & 3 \\ 1 & 1.1 \\ 1.1 & 2.1 \\ 1.2 & 3.1 \end{bmatrix}$$

Extracting the first segment only (or only segment if not sequence trace)

$n := (1 + a_{0,0}) .. (a_{0,0} + a_{0,1})$

$m := 0 .. 1$

$firstseg_{n-1-a_{0,0},m} := a_{n,m}$

$$n = \begin{bmatrix} 3 \\ 4 \\ 5 \end{bmatrix}$$

$$firstseg = \begin{pmatrix} 1 & 1 \\ 1.1 & 2 \\ 1.2 & 3 \end{pmatrix}$$

Extracting a given segment

$numsegments := a_{0,0}$ Total number of segments in trace

$seglen := a_{0,1}$ Number of samples in each segment

$segment := 0$ Desired segment number

$segstart := 1 + numsegments + segment \cdot seglen$ Index of first point in segment

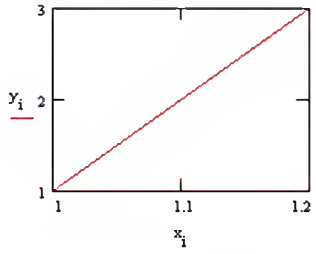
$segend := segstart + seglen - 1$ Index of last point in segment

$segtime := a_{segment+1,1}$ Segment trigger time

$x := a^{\langle 0 \rangle}$

$y := a^{\langle 1 \rangle}$

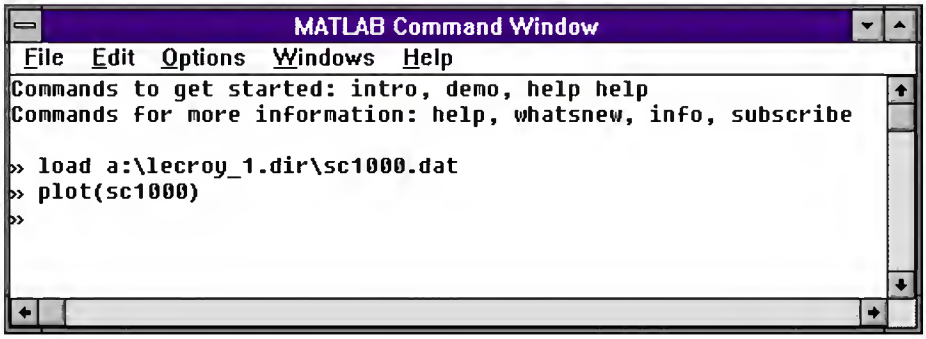
$i := segstart .. segend$

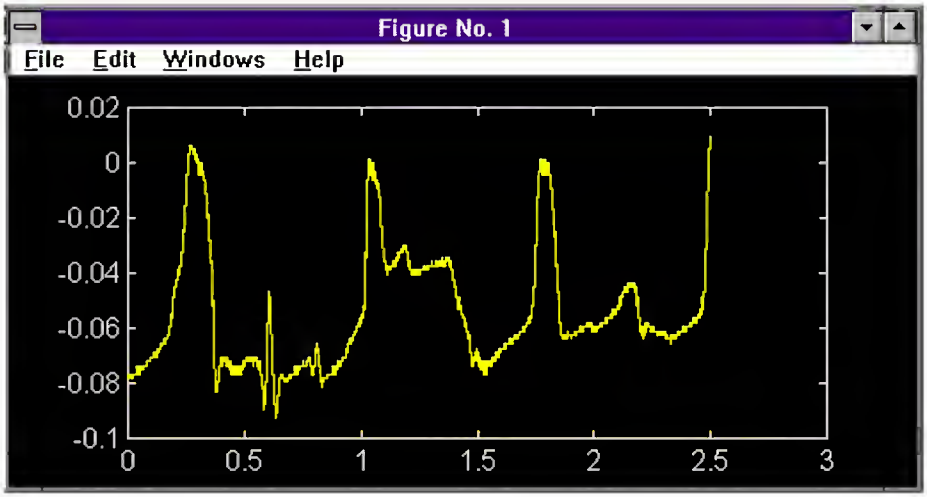


Using MATLAB

This example was created using MathWorks' MATLAB Version 4.2c.1 for Windows.

Reading and graphing a waveform in MATLABmay be achieved with two simple commands, as the following example shows. The first command loads the file into a matrix which is automatically named after the file. The second command plots this matrix.





Detailed Description of the Formats

Spreadsheet **Format**

> ***Note:*** *Fields in bold type are constants that are present in the output file as shown. Fields in italic are variables that are filled in when the file is written.*

<scopeid>,	*<scopeserial>*	
Segments,	*<numseg>*,	**SegmentSize,** *<numpts>*
Segment,	**TrigTime,**	**TimeSinceFirstSegment**
#1,	<trigtime(1)>,	**0.0**
...	...	
#<numseg>,	<trigtime(*numseg*)>,	<trigdelta(*numseg*)>
Time,	**Ampl,**	**[Ampl1]**
x(0),	*y(0)*,	*[y1(0)]*
x(1),	*y(1)*,	*[y2(0)]*
...	...	
*x(numgseg*numpts)*,	*y(numseg*numpts)*,	*[y1(numseg*numpts)]*

Single-Segment Example

```
LECROY9354,935412345
Segments,1,SegmentSize,502
Segment,Trig Time,TimeSinceFirstSegment
#1,21 Mar 1990 9:37:08,0.0
Time,Ampl
0.0,1
0.1,2
...
```

Multi-Segment Example

```
LECROY9354,935412345
Segments,3,SegmentSize,502
Segment,Trig Time,TimeSinceFirstSegment
#1,21 Mar 1990 9:37:08,0.0
#2,21 Mar 1990 9:37:13,5.0
#3,21 Mar 1990 9:37:15,7.0
Time,Ampl
0.0,1
0.1,2
...
0.0,1.1
0.0,2.1
...
0.0,1.05
0.0,2.05
```

Dual-Array Example

```
LECROY9354,935412345
Segments,1,SegmentSize,502
Segment,Trig Time,TimeSinceFirstSegment
#1,21 Mar 1990 9:37:08,0.0
Time,Ampl
0.0,1.1,1.1
0.1,2.1,2.1
...
```

Note:

- ***The basic structure of the Spreadsheet format is a header containing scope identification information, followed by a block containing trigger times for multi-segment waveforms, followed by the data itself.***
- ***This format is compatible with the ASCII import of the LeCroy LW4xx Arbitrary Function Generator.***

Mathcad

Format

<"scopeid">
<"TriggerTime">

<numseg>	*<numpts>*	
Segment	**TimeSinceFirstSegment**	
1	0.0	
...	...	
<numseg>	<trigdelta(*numseg*)>	
Time	**Ampl**	**Ampl1**
<x(0)>	*<y(0)>*	*[<y1(0)>]*
<x(1)>	*<y(1)>*	*[<y1(1)>]*
...	...	
*<x(numgseg*numpts)>*	*<y(numseg*numpts)>*	
*[<y1(numseg*numpts)>]*		

Single-Segment Example

```
"LECROY9354,935412345"
"23-March-90,12:44:23"
1               502
Segment         TimeSinceFirstSegment
1               0.0
Time            Ampl
0.0             1
0.1             2
.....
```

Multi-Segment Example

```
"LECROY9354,935412345"
"23-March-90,12:44:23"
3                502
Segment          TimeSinceFirstSegment
1                0.0
2                5.0
3                7.0
Time             Ampl
0.0              1
0.1              2
.....
0.0              1.1
0.1              2.1
.....
0.0              1.05
0.1              2.05
```

Note:

- *The format created for MathCad is very similar to the Spreadsheet format, but with some differences due to the way MathCad interprets the header information.*
- *One of the most important of these is that the absolute trigger time is only given for the first segment, with relative times (in units of seconds) being included for each segment.*
- *Another difference is that the scope identification and trigger time are wrapped in quotes to ensure that MathCad does not attempt to import them.*

MATLAB Files

Format

y(0)
y(1)
...
*y(numseg*numpts)*

Single Segment Example

```
1.0
1.1
1.2
...
4.5
```

Notes

- ***The MATLAB format is simple, without header information and having amplitude values only.***
- ***Multiple segments will be appended without a separator.***
- ***Only one value from the pair of amplitude values present in a dual-array will be stored.***